Marcus Tindall
University of Reading
e-mail: m.tindall@reading.ac.uk
B.S. Bhattacharya
University of Reading
P.K. Sweby
University of Reading
A. Minihane
University of East Anglia
K.G. Jackson
University of Reading

Genetic Regulation of Cholesterol Biosynthesis

The regulation of cholesterol production is fundamental to maintaining good human health. Sterol regulatory element binding protein (SREBP) is a key regulatory transcription factor for lipid synthesis. In this work we present a nonlinear ordinary differential equation model of SREBP transcription in the context of the HMGR cholesterol biosynthesis pathway. SREBP transcription is regulated by forming an inactive complex with its end product, cholesterol, to control homeostatic concentration levels of cholesterol within the cell. Mathematical analysis of the dynamical system of equations shows it admits three distinct types of behaviour: (i) oscillations in the mRNA, HMGR protein and cholesterol expression levels; (ii) oscillations in the mRNA, HMGR protein and cholesterol expression levels which decay in time; and (iii) non-oscillatory solutions. The number of binding sites between cholesterol and SREBP and SREBP and the genes are shown to be crucial factors in determining the system behaviour. We discuss the consequences of our work and show how our results provide a receipe for synthetic biology in the context of homeostasis.